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AMERICAN

STATISTICAL ASSOCIATION.

NEW SERIES, No. 14. JUNE, 1891.

Presented to the AMERICAN STATISTICAL ASSOCIATION, May 15, 1891.

A BASIS FOR STATISTICS OF COST OF PRODUCTION.

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One of the most difficult features of statistical work is the adoption of a basis for the collection of the information desired. Such a basis should always comprehend the full scope of the inquiry, or, as the scientific statistician would term it, the "theory," underlying the investigation; that is to say, the basis adopted should be broad enough and specific enough in its details to comprehend all that might be reasonably expected to result from a statistical inquiry on a special subject. The basis should also be considered with a view to the presentation in proper form of the facts collected. Should this latter feature be lost sight of in the preliminary work of an investigation, much difficulty would be experienced in the compilation of the original data. The official statistician who is instructed by the legislative power to collect information on a great subject must make a pretty thorough study of the possibilities of securing information and of the obstacles to be overcome in prosecuting his inquiries. Probably no severer test of the feasibility, at least of collecting original information, has been made than that accompanying the investigation now about completed by the United States Department of Labor on the cost of production. I am not aware that any government has ever required so difficult a task at the hands of its statistical forces as that comprehended in the instructions of Congress to the Department of Labor in the act establishing the Department. This act charged the Commissioner of Labor to ascertain, at as early a date as possible, and whenever industrial changes shall make it essential, the cost of producing articles at the time dutiable in the United States in leading countries where such articles are produced, by fully specified units of production, and under a classification showing the different elements of cost or approximate cost of such articles of production, including the wages paid in such industries per day, week, month, or year, or by the piece, and the hours employed per day, and the profits of the manufacturers and producers of such articles, and the comparative cost of living and the kind of living. As I have intimated, I know of no statistical task required of an office severer than this required by Congress. There may be one exception,— when the Congress required of the Census Office the collection of facts relating to mortgage indebtedness. It will be seen by the language of the law which I have quoted that the object was to secure a comprehensive collection of information which should show the cost of producing articles in different countries, the efficiency of the labor engaged in their production, and the cost of the living of the producers, as well as the kind of their living. Of course, under such a broad designation of duties, the first difficulty that would arise would be the formulation of the proper inquiries necessary to secure the specified information. The advice of producers in various industries, experienced men and experts in their particular lines, was freely sought and as freely given, the result being a series of schedules, scientific in their nature, which would result, if properly filled, in securing the desired information. After the fullest consideration of the instructions of Congress and consultation with manufacturers and experts in different industries and from different parts of the country, it was determined to make the investigation as broad as possible, so that the study of the cost of production in such industries as might be selected should be searching and analytical. To do this it was of course necessary that the information collected should be upon a uniform basis, so far as each industry was concerned, and, in fact, so far as the bulk of the industries investigated were concerned. It will be understood at once that but few industries could be covered under the instructions of Congress. To ascertain the cost of production, there must be a clearly defined unit of production; so, the industries selected were selected with this feature in view, consideration also being taken as to the volume of revenue which the importation of each article bore to the whole revenue of the country. The industries selected, which seemed to offer the opportunities for investigation on well defined units, were all the textile industries, glass and glassware, iron ore, iron, steel, etc. These industries, through the importation of articles manufactured in the various branches of these industries, produced, for the year ending June 30, 1889, about 47 per cent of the revenue of the country.

The investigation assumed three great features or divisions, the first relating to the cost of producing the articles selected, which, as I have said, must necessarily be articles having definite and equal units, such as a ton of bessemer pig iron, rather than a steam engine or a mowing machine; the second feature covering rates of wages, time, earnings, and the efficiency of the labor connected with the establishments furnishing the information on the cost of production; the third feature being the collection of facts covering the cost of living, total earnings, and expenditures of the men employed in the establishments called upon to furnish data relative to the cost of production, earnings, and efficiency.

The facts under the first feature were to be taken from the account books of the establishments producing the goods; for the second (wages, time, etc.) from the actual pay rolls or pay accounts of such establishments, while all facts relating to the cost of living and expenditures of men and their families were to be gathered from the men themselves. I am exceedingly happy to state that this wide and comprehensive plan, as originally adopted, has been carried out relative to the great industries named, and to an extent and with a success far beyond my expectations when it was adopted. I am free to say, however, that the results of this great inquiry, as must be the case in all other investigations, do not reach the statistical ideal of the collection and presentation of important facts; but the result can honestly be designated a "statistical triumph," in securing which many intelligent, fearless, and well informed manufacturers have been willing, for the benefit of the public, to give all the facts called for relative to their business. It is an exceedingly delicate matter to ask a manufacturer to give all the facts and figures relating to the cost of producing his goods, but manufacturers, like other people, are becoming familiar with the idea of governmental inquiry into conditions, and are more and more convinced that not only does no harm come to them from an honest statement of the facts sought, but, on the contrary, that great good may be derived from such statements. Of course, not every manufacturer who was asked to furnish the information called for by the Government accepted the invitation; but in the iron and steel, coal and coke industries the proprietors of 618 establishments in this and other countries responded and contributed facts necessary for a fairly complete report on the subject, while in the textile and glass industries the proprietors of more than 250 establishments have furnished full information covering more than 1000 separate units.

The methods adopted aided the prosecution of the investigation to a very large degree. Experts and agents were sent directly to the producers. The difficulties met with by the American Iron and Steel Association, as testified to by the secretary of that body, as involved in making a reply to the Honorable Secretary of the Treasury as to the cost of producing iron and steel, taught the Department something, and induced it to rely upon the methods which I have always found most effective. This method may be called the "personal" method, that of sending experts and agents directly to the producer, as I have said. The experience of the Association referred to, and of all statistical bureaus engaged in the collection of industrial statistics, has for many years condemned the correspondence method of collecting facts. It has, with rare exceptions, been a failure. The personal method, that of sending well informed and well instructed agents to obtain in person what is wanted, and to fill the schedules themselves from the books of account, is the only one that will secure satisfactory results. The great merit of this latter method is that a well informed man on the spot can answer all objections and show clearly all advantages.

What I have said relates entirely to the comprehensiveness of the work delegated by Congress to the Department of Labor in respect to cost of production and the general plan of carrying out the legislative requirements. It has been difficult enough in prosecution, but the difficulties were not ended with the laying out of the plan or even with carrying it out. The great question which had to be taken into consideration, and which involved more than statistical skill or ingenuity, related to the economic features of the investigation; so the question, What is meant by cost of production? had to be answered, and in such a way as to enable the Department to present its facts. The essayist, the writer on political economy, can answer such a question without any difficulty whatever, because he has simply to arbitrarily determine what he considers cost of production, and then argue to that end. The statistician is obliged to answer the question as a practical matter. He must determine what elements should enter into the answer; and so whatever was determined as meaning the cost of production determined the basis for statistics of cost of production. I believe I recognize and appreciate the purely economic discussion of what is meant by the term, "cost of production," and the economic sense of the term, in its various features, has been very well stated by Prof. Giddings, of Bryn Mawr College. Without adhering closely to Prof. Giddings's language, I will give his general view of the subject. The term, "cost of production," is used with at least four different meanings in economic discussions.

First. The fatigue or irksomeness of labor. All those engaged in extractive industries are fully conscious of this particular meaning of cost of production. The effort and weariness of the farmer counts with him for the cost of this or that farm operation. Prof. Cairnes insisted that in economic theory cost of production must always mean fatigue of muscle and of brain. He considered wages, interest, etc., as the rewards of production.

Second. Cost of production may mean the destruction of one objective or material utility in the production of other utilities. One manufacture destroys the products of another industry. We destroy seed, grain, fertilizers, etc., in producing agricultural crops, and we destroy coal to produce steam power. Prof. Giddings says we have to use "cost" in this sense whenever we inquire whether a nation is increasing its material means of satisfaction by the ways in which it consumes its resources. This is a very true statement. The production of iron and steel means the destruction and consumption of the great sources of ore, coal, etc.

Third. By the cost of production we may mean the sacrifice of an opportunity or of a value, or, as Prof. Giddings very forcibly illustrates it, the blacksmith might be able to make $1.50 a day as an agricultural laborer, when any other man in the neighborhood could make but $1.25; but, being able as a smith to make $2.00 a day, he stays at his forge. He will estimate the cost of production of his work at the value of his best alternative employment,— the $1.50 a day. It is in this sense, the Professor says, we constantly use the word cost in discussions of international trade. Thus a nation that could produce iron at $11 a ton may import it at $13, simply because the labor and capital that would produce a ton of iron at $11 may be productive of enough wheat or cotton to buy a ton and a half or two tons at $13.

Fourth. Cost may mean the sum of all the prices paid for the materials and labor and sacrifices involved in production, and this is what the business man ordinarily means by cost of production,— that is, the expense of production. And it is in this sense, or in considering this sense, that the statistician must project his basis for securing and presenting the statistics of cost of production. It should be understood, to again quote Prof. Giddings,— not literally, but generally, — that cost in this latter sense is not always a *cause* of value or price; that is, the price of a product is not necessarily determined by its cost of production in the terms of the prices of labor and materials; on the contrary, the price of the final product may determine how much the producer will offer for materials and labor. The difficulties often experienced in economic discussions of determining exactly the relations of cause and effect hold good in this matter. More than one final product is commonly made from the same raw material, and the prices of those products, even after allowing for all other differences in expenses, may be very unequal. Nevertheless, the various producers will buy their raw material at substantially the same price, and that price cannot exceed the market value of the least valuable product made from the material. This is not always so in practice, but it is true theoretically. So, therefore, it is the least valuable product which largely determines the cost of production for all other products made from the same raw material, or by substantially the same kind of labor.

Recognizing these different meanings of the term, cost of production, it is evident that only a few of them, and to a certain extent, can enter into the statistical basis, and these elements of a basis must comprehend the expenses of production, the cost of production as expressed by the consumption of time, and the cost of production as expressed by the destruction of the resources furnished by nature. Not only economically speaking, but practically, these three features should enter in as the great elements of any comprehensive basis for statistics of cost of production. The other elements which I have referred to can hardly be comprehended by statistical inquiries, although all-important in any complete analysis of the cost of production.

In the investigation under review, therefore, cost of production has been stated in the three ways just enumerated, — the expense of production, the cost as determined by the consumption of time, that is of labor, and the cost as determined by the destruction of natural elements. But this is not sufficient; this is a statement of a conclusion. How shall we arrive at a basis on which to collect and present facts showing the expense of production? It is in this particular feature that all discussion would properly arise as to any determination for a basis. An examination of the elements of destruction of raw material, like iron ore, etc., is a simple affair, on which there can be no discussion; the consumption of time, or the destruction of the labor of man, is a simple matter, on which there can be no discussion by economists or business men; but when we come to what constitutes the expense of production, that is, the business view of the cost of production, there is opened a wide field for discussion, and one which will involve the integrity of any basis for the collection and presentation of statistics of cost of production.

In the report resulting from the investigation to which I have referred, and as ordered by Congress, the term cost of production has not been used in any technical or metaphysical sense, although from the facts reported the economic cost of production, as indicated by the waste or consumption of material or of time, can be clearly ascertained. In arriving at the cost of production all expense of interest, insurance, depreciation of the value of plant, and (where existing) royalty to the owners of the soil has been excluded, as have also all charges for freight of product to place of free delivery. The facts upon these points, except the last, have been collected from such manufacturers as have seen fit to give them and have been tabulated separately, so that anyone who does not agree with the position of the Department of Labor can for himself ascertain what the cost of production would be with these excluded elements added. For the purpose of the investigation it was deemed sufficient to include only those elements of cost which are universal, positive, and absolutely essential, that is, those elements of cost that are common to all producers and which must be borne in order to bring out the completed product.

Interest can hardly be called an element of cost of production because of the variation of the amount of interest which enters into the estimates of concerns. Moreover, an establishment may have no interest money to pay, considering its plant as "sunk," or it has charged off a certain percentage each year for a sufficient number of years to wipe out the entire cost of plant, and so thereafter interest can play no part in the balance sheets or accounts of the concern. The whole amount charged off has been paid out of profits, and could not be reckoned as any part of the cost of producing a single ton. The man who pays a large interest must be content with a smaller profit. If he borrows his capital he reduces his margin of profit. The concern that has completely wiped out the cost of its plant, through a systematic and continued charging off, has the advantage, and its subsequent profits are larger. Some manufacturers in different industries charge, for instance, six per cent on the entire plant to the cost of production, dividing it over the year's output. In such a case, if the goods are sold at this cost, the manufacturer claims that he has made no profit, when in fact he has made six per cent, and this six per cent offsets the interest he would have obtained for his capital invested in some other direction. He loses his personal services, however; or, to state it differently, he secures six per cent for the care of his capital. Most European producers of iron and steel, and all in America inquired of, have been found to consider their plant sunk to start with, and have advised the Department that the only influence which the value of plant can have upon the cost of production is through charges for repairs, and not through interest added to the positive elements of cost.

The depreciation of value of the plant, which often occupies so much of the attention of writers when speaking of the cost of production, offers a very great stumbling block in any statistical study of the cost of production. In arriving at our conclusions, which resulted in not considering this as a positive and universal element in the cost of production, we have been greatly aided not only by the manufacturers themselves, but by a work on The Depreciation of Factories and their Valuation, by Ewing Matheson, M. Inst. C. E., published in London in 1884.

It is true that the cost of repairs should be charged into the cost of production, and it is believed that the full force of the idea that depreciation should enter into the cost of production has in this way been met; that the integrity of the influence of depreciation has been preserved, and without the difficulties which would arise from an attempt to add any sum representing depreciation.

Deterioration of plant by time and use, the appraisement of the loss and its allotment in the accounts, are matters of great importance, of course, in the economy of management; but no fixed rules or rates of depreciation can be established for general use, because not only do trades and processes of manufacture differ, but numerous secondary circumstances have to be considered in determining the proper course. The question of depreciation cannot be separated from that of maintenance, and in theory one may be said to balance the other. If this be the case, the absolute replacement of some portion of the plant every year may thus maintain an average aggregate value. In only two kinds or classes of plant, however, can such an exact balancing of loss by repairs and renewals be ventured on; one, where the plant wears out so quickly as to need replacement at short intervals, affording constant proof by the mere continuance of working that not only the earning power of the factory is maintained, but also the capital value; and in a second class that of undertakings so large and permanent as to afford a wide average of deterioration and renewal over the whole plant. In the conduct of works there is often a natural tendency to charge off for depreciation in proportion to the profits rather than to the deterioration, and where such a tendency is crystalized into action, the amount charged off being large in a year when the profits are large, the cost of production, should such amount be considered as an element in it, would be thrown out of legitimate proportion.

In the case of a very large plant, where there is considerable annual outlay for renewals as well as for repairs, such expenditure, if charged to profit, may fairly balance the average deterioration of the whole; but to secure this there should be a very ample margin, through the increase of the plant every year, for without this there would be a risk that a gradual lessening of the total value of buildings or plant would take place, ultimately involving considerable expenditure to restore its earning capacity, and this great expenditure, if added to the cost of production, would again distort the legitimate proportions thereof. In the accounts of a plant it is difficult, even for those engaged in its management, always to distinguish between the expenditure for renewals chargeable to capital and that due to deterioration; and to those outside the management it is quite impossible without careful investigation. Actual additions to the size or capacity of a plant should be largely reckoned as increasing the fixed capital, but such an increase may be wholly or partially neutralized by deterioration. There are various methods of estimating the depreciation of a factory or plant, but it may be said in regard to any of them that the object in view is so to treat the nominal capital in the books of account that it shall always represent as nearly as possible the real value. The most effectual method of securing this would be, if it were feasible, to revalue everything at stated intervals, and to charge off whatever loss such valuations might reveal without regard to any prescribed rate. By such a plan the deterioration due to a period of constant working and of great profits, or to an average or idle year, might be properly allotted.

Such a system is adopted oftenest in factories or works where the trade and plant are of so simple or uniform a kind as to allow it without difficulty. In some manufactories there are a few chief items of plant which are more important than the rest, and whose condition and value therefore need special consideration. But, as a rule, it will be found that charging repairs to cost of production and great extensions or increase of capacity to capital serves the best economic purpose in securing the legitimate cost of production.

In the case of machinery, deterioration depends on so many circumstances, some of which relate to the machine itself, and others to the mode of using it, that it is difficult to establish a just and uniform rate of depreciation which would with integrity be chargeable to the cost of production. Sometimes a machine as a whole may continue serviceable, while important parts may become obsolete. Thus, in an iron rolling mill, new rolls may be cut to produce a certain pattern of bar iron, and if this pattern be of a standard shape and size, constantly in demand, depreciation may be based on its probable durability and the number of tons of iron which the rolls will produce before they are worn out. If, on the other hand, the pattern be peculiar in shape or size, a higher rate of depreciation is necessary, and it may become proper to charge the whole cost of the rolls to the first out-put of bars. In this latter respect the rolls must be treated like foundry patterns, which are in some cases charged to one set of castings for which they have been specially made, and at another time as stock or standard patterns to capital. There are numerous other industries where a large proportion of the cost of manufacture is for the design and patterns, and a due depreciation in value would become of great importance.

There is a very wide divergence of practice, even in well-managed factories, as to the proper rate of depreciation for machinery. To be on the safe side a concern sometimes commences by charging off annually 10 per cent from the cost of all machinery, especially when the concern is doing a profitable business. In other cases the records of many years' working may show that 2½ per cent is sufficient. In engineering factories the rate which will probably meet the depreciation will generally be found between 5 and 10 per cent. Where the work is of a moderate kind which does not strain the machines severely, and where the hours of working do not average more than sixty per week, 5 per cent would generally suffice for machinery, cranes, and fixed plant of all kinds, excluding steam engines and boilers. Where there is a diversity of machinery and plant, as in a cotton mill, prominent cotton manufacturers, with many years' accounts to enable them to form a correct jndgment, have informed the Department that 5 per cent seems to be an appropriate rate to be added to the cost of production when this method is resorted to; but such a rate would be quite insufficient for the machinery of a rolling mill. While a rate of 7½ per cent might be supposed sufficient for the first few years, say four, the valuation at the end of that period might show that some rate between 10 and 20 per cent would be necessary to meet effectually the depreciation in value due to wear and tear, and to the fact that the machinery is likely to become old-fashioned.

Steam engines and boilers, if classed separately from the other machinery of a plant, would generally require a higher rate of depreciation, and a further separation would require that the boilers be given a rate higher than engines. The make of the boilers and engines would have much to do with the depreciation. In trades where steam engines, steam hammers, furnaces, and boilers form a large proportion of the total plant of machinery, they would have to be classed separately from the other machines, or the rate of depreciation for them should determine that for the whole; but it is often considered expedient to exclude from such a general rate of depreciation certain things, such as patterns and foundery boxes, or to class them separately. Where the depreciation is rapid, as in boilers and furnaces, the need for renewal forces itself on the attention of users, and the justice of charging expenditure on this account to profit becomes obvious, and of course to charge such to cost of production would be entirely wrong. From these considerations, and to avoid inharmonies and incongruous elements of cost, we have, to cover all contingencies and the variations of years, included repairs in the cost of production instead of undertaking to determine or accept any specified rates of depreciation by individual concerns.

The charges for insurance cannot justly be considered for statistical purposes as an element of cost of production. It is a variable and often unknown quantity. Many proprietors prefer to carry their own insurance, while others prefer to place their risks with insurance companies. This takes the cost of insurance out of the catalogue of positive and universal elements of the cost of production.

The royalties paid to the owners of the soil in the cases of coal mines, ore mines, or limestone quarries, operated by persons other than the owners, should not be included, because such charges are not positive and universal, and must of necessity correspond to the interest charge of the operator who owns his mine. In other words, the royalty paid by the lessee represents what would be the interest on capital invested were he the owner, and is not considered as a legitimate charge against cost of production, although affecting profits or selling prices.

The charges for freight of product from the works to place of free delivery should not be included as one of the positive elements of the cost of production, because they are manifestly a part of the cost of selling the finished products, and the plans of an investigation could necessarily carry the product only to the point of finishing at the works. Moreover, such charges are variable, the products of many mills being sold free on board at mills, and of others at such a variety of points that no usable statement could by any possibility be obtained. This latter reason prevented the department from showing among the additional or theoretical charges the comparative advantages of the several establishments in respect to their proximity to market.

Notwithstanding these considerations, there are many students of economic subjects, as already intimated, who regard some one or all of these elements —interest, insurance, depreciation, and royalties —as legitimate elements in arriving at the cost of production, and for that reason a separate tabulation of such data on them as came to hand has been made. It will be found, however, on examining the short tables at the close of this article, that in nearly all cases their influence upon the cost of a unit, like a ton of pig iron or a ton of steel rails, is so slight as not to invalidate the statements made in the tables where they have been excluded.

Another disturbing element in ascertaining exact cost of production is the market price at which materials are charged. A manufacturer of pig iron may also be the producer of the ore or coke, coal, or limestone which he uses, or he may be the producer of some of these materials and a purchaser of others. If he is a purchaser, he is entitled to charge as a legitimate element of cost what he has to pay in the market for the materials, and it sometimes occurs that where a manufacturer produces his own ore or other materials, he considers it perfectly legitimate in making up his cost to enter what he produces at the market price he would have to pay for it provided he purchased. This statement will often account for discrepancies in the cost as charged for different materials. The influence of this is more largely felt in the production of steel rails, where the fluctuation of prices of pig iron is great, as shown by the speculation in pig iron in Great Britain. It is extremely difficult to arrive at the specific elements of cost in the production of pig iron in Great Britain on account of the constant gambling there in pig-iron warrants. This species of speculation has been carried to such a reckless extent that a measure has been introduced into Parliament for regulating dealings in pig-iron warrants. The measure aims at such speculative dealings, especially those characteristic of the Glasgow market, where it is no uncommon occurrence for operators to buy and sell enormous lines of warrants without possessing or desiring to possess a single ton of iron. Much harm has certainly at various periods been inflicted on the British iron trade as an industry by the wild gambling carried on by the iron rings, not alone through the destructive operations of bears, but also through the injudicious proceedings of sanguine bulls. The influence of this species of speculation distorts prices and, of course, costs, and it has much to do with the irregularities noticed in the quotations of steel rails. The cost of production is also affected by the freight charges on the assemblage of raw materials, like ore, coal, coke, etc. The cost of transporting ore, for instance, will vary as between two establishments located side by side and bringing their ore from the same mine. One establishment may have influence with the road by which rebates are obtained, while the other establishment, having no such influence, is obliged to pay the full official rates. While such conditions are not frequent, nevertheless, in some cases, they are disturbing elements in the attempt to arrive at exact cost of producing pig iron or steel.

In order to illustrate practically and with figures the influence of what have been designated "theoretical elements" upon the cost of a unit, I have drawn some brief tables from the report on cost of production described above. The following table shows the summary of cost of run of furnace pig iron in twenty-six establishments in the northern district of the United States, meaning by the "northern district" states embracing Pennsylvania, Ohio, and that line of states producing pig iron: —

Elements of Cost.	Tons of 2240 pounds.	
	Cost of 544,377.	Average cost of one.
Ore	$3,787,982	$6.958
Cinder, scrap, etc	313,679	.576
Limestone	273,207	.502
Coke	1,810,814	3.327
Coal	201,940	.371
Total materials	6,387,622	11.734
Labor	802,283	1.474
Officials and clerks	100,607	.184
Supplies and repairs	277,413	.510
Taxes	19,615	.036
Total	7,587,540	13.938

The cost of theoretical elements, consisting of insurance, interest, and depreciation of value of plant, in some of the establishments from which the figures for the foregoing table were taken show an additional cost of $0.166 per ton, divided as follows: For insurance, $0.008; for interest, $0.122; for depreciation of value of plant, $0.036.

The following table shows the summary of cost of run of furnace pig iron in twenty-four establishments in the southern district of the United States.

A few of the establishments from which the following figures are taken show that insurance would add $0.006 per ton, interest $0.096, and depreciation of value of plant $0.066, or a total for these of $0.168 per ton. In the northern district it was $0.166.

Elements of cost.	Tons of 2240 pounds.	
	Cost of 647,728.	Average cost of one.
Ore	$2,245,830	$3.467
Cinder, scrap, etc	10,011	.015
Limestone	304,142	.470
Coke	2,889,676	4.461
Coal	800	.001
Total materials	5,450,459	8.414
Labor	987,111	1.524
Officials and clerks	105,962	.164
Supplies and repairs	397,550	.614
Taxes	25,372	.039
Total	6,966,454	10.755

Turning to the Continent of Europe, the following table, giving positive elements, shows the summary of cost of run of furnace pig iron in one typical establishment on the Continent of Europe, with the summary of cost of theoretical elements added: —

Elements of Cost.	Tons of 2240 pounds.	
	Cost of 33,685.	Average cost of one.
Ore	$154,773	$4.595
Cinder, scrap, etc	67,942	2.017
Limestone	13,006	.386
Coke	97,028	2.880
Coal	238	.007
Total materials	332,987	9.885
Labor	47,620	1.414
Officials and clerks	8,225	.244
Supplies and repairs	16,428	.488
Taxes	1,321	.039
Total	*a* 406,581	*b* 12.070

SUMMARY OF COST OF THEORETICAL ELEMENTS IN THE ABOVE.

[The establishment covered by this summary reported that it had no insurance, and that there was no expenditure for interest. It gave the amount charged to depreciation, which makes the sum credited to that item below.]

Insurance	....	....
Interest	....	....
Depreciation of value of plant	$19,846	$0.589
Total	19,846	.589

a From this amount should be deducted $35,089, the value of lead, zinc, and other incidental products of manufacture.

b From this amount should be deducted $1.042, the value of lead, zinc, and other incidental products per ton of iron produced, leaving the total net cost $11.028.

Taking up another quality of iron, gray forge pig, the cost per ton of the positive elements is shown in the following summary made from eight establishments in the northern district of the United States: —

Elements of Cost.	Tons of 2240 pounds.	
	Cost of 195,631.	Average cost of one.
Ore	$1,248,808	$6.384
Cinder, scrap, etc	226,402	1.157
Limestone	106,883	.546
Coke	575,759	2.943
Coal	80,419	.411
Total materials	2,238,271	11.441
Labor	257,677	1.317
Officials and clerks	29,255	.150
Supplies and repairs	110,558	.565
Taxes	5,254	.027
Total	2,641,015	13.500

The insurance for several of the establishments covered by this last table was $0.011, interest, $0.136, and depreciation of value of plant, $0.050, or a total of $0.197 per ton.

For Great Britain, on the same kind of iron, gray forge pig, the results drawn from the returns of three establishments are shown to be as follows: —

Elements of Cost.	Tons of 2240 pounds.	
	Cost of 34,696.	Average cost of one.
Ore	$127,733	$3.681
Cinder, scrap, etc	1,478	.043
Limestone	12,539	.361
Coke	99,997	2.882
Coal	908	.026
Total materials	242,655	6.993
Labor	24,178	.697
Officials and clerks	1,695	.049
Supplies and repairs	9,132	.263
Taxes	994	.029
Total	278,654	8.031

None of these establishments considered depreciation of value of plant as a legitimate charge to cost of production, but from two of them it is found that the insurance would be $0.001 per ton, interest, $0.199, or a total of the theoretical elements of $0.200 per ton additional cost, were they added to the foregoing positive cost.

The following table shows the cost of positive elements of Bessemer pig iron in twenty-four establishments in the northern district of the United States: —

Elements of Cost.	Tons of 2240 pounds.	
	Cost of 797,772.	Average cost of one.
Ore	$7,346,496	$9.209
Cinder, scrap, etc	83,002	.104
Limestone	345,769	.433
Coke	2,630,997	3.298
Coal	164,447	.206
Total materials	10,570,711	13.250
Labor	1,105,622	1.386
Officials and clerks	126,015	.158
Supplies and repairs	425,056	.533
Taxes	31,158	.039
Total	12,258,562	15.366

From the returns of the establishments that considered what I have designated "theoretical elements" as part of the cost, it is found that insurance adds $0.009 per ton, interest, $0.103, depreciation of value of plant, $0.110, or a total of $0.222 per ton. There is no Bessemer pig iron made in the southern states; or, at least, there was not at the time the facts herein given were collected; but for Great Britain the cost of positive elements of Bessemer pig in four representative establishments was as follows: —

Elements of Cost.	Tons of 2240 pounds.	
	Cost of 174,144.	Average cost of one.
Ore	$1,066,282	$6.123
Cinder, scrap, etc	33,819	.194
Limestone	36,740	.211
Coke	459,081	2.636
Coal	1,914	.011
Total materials	1,597,836	9.175
Labor	116,429	.669
Officials and clerks	9,762	.056
Supplies and repairs	70,771	.406
Taxes	3,405	.020
Total	1,798,203	10.326

The theoretical elements in the Bessemer pig, as given by several of the foregoing establishments, consist entirely of interest charge, which is $0.084 per ton, neither of the establishments considering it worth while to incorporate insurance and depreciation of value of plant in the cost.

From the considerations which have been given of the difficulties surrounding the collection and classification of statistics relating to cost of production and the statistical illustrations drawn from the report in question, it will be seen that a basis for such statistics consists of two parts. First, all those elements of cost which are positive in their nature, which are absolutely essential for the production of articles, and which are universally uniform or generally uniform in their character. All the facts brought under this general designation should be considered altogether and entirely separate from what has been called theoretical elements. The second part of the basis should comprehend all those elements which are shifting in their nature, and which exist only in certain cases, and when they do exist are elements of advantage or disadvantage rather than essential elements in production.